COVID Game Model

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(Dated: January 25, 2021)

The model underlying the COVID Game

Regions indexed by n. Every nodes has S_n susceptible, I_n infected, R_n recovered, with $N_n = S_n + I_n + R_n$. The travel matrix T_{nm} says what fraction of time people from region m spend in n (can be chosen as Laplacian with negative diagonal to preserve overall time). C is the current state of countermeasures, and the infection probability depends on the fraction of susceptible people present and a function $\delta(C)$.

Then we have a coupled stochastic SIR model in terms of the binomial distribution $\mathrm{Bin}(,)$:

$$\Delta R_n = \mathrm{Bin}(\beta, I_n) \tag{1}$$

$$I_n^{eff} = I_n + \mathrm{round}\left(\sum_m T_{nm} I_m\right) \tag{2}$$

$$\Delta I_n = \mathrm{Bin}\left(\delta(C)\frac{S_n}{N_n}, I_n^{eff}\right) \tag{3}$$

$$S_n(t+1) = S_n(t) - \Delta I_n(t) \tag{4}$$

$$I_n(t+1) = I_n(t) + \Delta I_n(t) - \Delta R_n(t) \tag{5}$$

$$R_n(t+1) = R_n(t) + \Delta R_n(t) \tag{6}$$

This is currently implemented. with $\delta(C)$ with C a discrete space. Easy to add would be:

- Several types of infected with different infectiousness δ (B117)
- background infection rate (dependent on countermeasures)
- infectiousness δ that depends on state in the region

Maybe a bit harder to add: A better infection probability than binomial (super spreader events?). Make this depend on counter measures (hard to parametrize)

Questions: is this sufficient to model the effect of countermeasures? Which countermeasures should we include and how do we parametrize their effect.

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